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HYDROELECTRIC POWER PLANT IN DOBSINA, CZECHOSLOVAKIA

[Summary: This report summarizes an article, "The Hydroelectric Power Plant i Dobsina," by Engineer Tarabcik (fnu), which appeared in the No 9, September 1953 issue of Priroda a Spolocnost (Nature and Society), published in Turciansky Svaty Martin by the "Osveta" Publishing House, national enterprise. The report includes four figures, with accompanying legends, showing various installations connected with the Dobsina Power Plant]

During the latter part of the 19th Century and the beginning of the 20th Century, technicians began to consider the idea of constructing a hydroelectric power plant in Dobsina. During World War I, utilization of the water power of the Hnilec River was still in the planning stage, but after the war, building within the country was stopped and the idea remained unrealized.

After World War I, industrialization of Slovakia ceased; many foundries and mines in the Spiss-Gemer Ore Mountains (Spisskogemerske rudohori) were closed down. Under such conditions, there was no interest in building an electric power base in Slovakia. The owners of the Ostrava coal mines were afraid of building an electric power base, and every idea for building hydroelectric power stations was blocked in Parliament through their influence. The country was suffering a crisis of unemployment. The state did not have the means of making investments, and the owners of the coal mines were busy proving that the construction of water projects was a luxury, that water power was much more expensive than thermal electric power, and that the construction of such hydroelectric power plants would only increase unemployment.

The idea of constructing a power plant at Dobsina, however, was stronger than all of the confused economic considerations which were being held forth. It was aided by the marked difference in elevation between the small Hnilec River and Dobsina Creek. This difference in elevation gave impulse to a plan for utilizing the water power of the Hnilec River by transferring the Hnilec waters, via a tunnel, through the mountain massif dividing the two water basins. According to the plan, under further pressure, water would be piped through metal conduits onto the high-pressure turbines in Dobsina where the power would be utilized and the water would flow on into Dobsina Creek.

The Central Slovakian Electric Power Plants (Stredoslovenske Elektrarne) first attempted to realize this idea in 1930 when they vied for a concession for this water project. The necessary geological exploration, to determine the site for location of the dam as well as the reservoir's water tightness. Later, another plan was made but not carried out. This plan called for a very small reservoir capacity and a low dam which would have raised water to a level 16.50 meters lower than the one now being constructed. This plan would have affected the construction of the Cervena Skala-Margecany railroad, which was built at a relatively low elevation in the valley. Also, the amount of water which was to pass through the turbines was about one fourth the present transferrable amount.

The second serious attempt was made by the Slovak Electric Power Plants (Slovenske Elektrarne) in Bratislava on the basis of a new plan worked out by the [illegible] firm. This project was on a larger scale, but it also called for a reservoir on the Hnilec River only one fifth the size of the one now being constructed. The amount of water which was to pass through the turbines was greater than the amount called for by the present plan by approximately 160 percent.

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In 1945, additional alternatives were studied before adoption of the present plan of construction.

The Hnilec River has its source at the foot of Kralova Hola Plateau, the most highest divide in Slovakia. Three of the largest Slovak rivers, the Vah, Hornad, and Hron, have their origins here. The Hnilec Dam is being built on the headwaters of the Hnilec River. It stores 84 square kilometers of the headwaters of the river's watershed, which is only an insignificant percentage of its total. This is more readily apparent when it is realized that the Vah River basin covers approximately 10,650 square kilometers.

The capacity of the reservoir is equal to one fourth of the annual volume of water passing through the dam.

The reservoir will store the water from the entire watershed above the dam. The water will then be carried off through a pressure tunnel with an inside diameter of 2.12 meters and a length of about 1,400 meters to the equalizing chamber and the rapid-sealing chamber. From there the water will pass through tapered steel pressure conduits, with a maximum inside diameter of 1.8 meters and a length of 1,400 meters, to the power plant in Velka Dolina (Valley) near Dobsina. The plant contains two high-pressure units. Each of these units has a high-pressure "Francis" turbine; the generator is also used as an alternator (electric motor) to power the associated high-pressure pumps, which are installed on a single horizontal axis with the turbine and generator.

Water from the turbines will pass into the storage basin constructed in the Velka Vlci Valley through a concrete gravity dam directly above the plant. The arrangement of the power plant and the dam is illustrated in Figure 2 [appended]. The capacity of the Velka Vlci Valley Basin is about two thirds of the daily peak inflow. By the use of the evening electric current produced by the thermal electric power plants and the Vah River hydroelectric power plants, water will be pumped from the storage basin back into the reservoir on the Hnilec River. The quantity of water which cannot be retained in the Vlci Valley storage basin will pass through a low-pressure, domestic unit with "Kaplan" turbines and a generator mounted on a common verticle axis. From the low-pressure unit, the water will flow into the exhaust canal and on out into the Dobsina Creek, where it enters Vlci Valley.

The most interesting part of this project is the pumping, which will be discussed further. The power plant at Dobsina is of the peak-load type (spickoveho typu). Slovakia's daily consumption of electric power is illustrated in Figure 1 [appended]. The shortage of electricity occurs during the morning, when work commences in the factories and the offices and when additional large amounts of power are used for lighting and cooking; and also in the evening, when the work in the factories is ended and the homes are beginning to utilize electricity for lighting and cooking. On the other hand, during nonworking hours or during periods of restricted work, the thermal electric power plants, or even the Vah River electric power stations, would have to produce surplus current which could not be utilized. This current is utilized to pump water from the storage basin in the Vlci Valley into the reservoir on the Hnilec River. This water, which has been transferred through pumping during the off-load period, i.e., during the time when there is a surplus of electricity, is again released from the high reservoir on the Hnilec River into the turbines of the Vlci Valley power plant and thus again performs its work and furnishes valuable peak-load power. When we consider the fact that peak-load power is at least three times as valuable as regular power, then the 40 percent loss of power resulting from the transfer of water through pumping, still seems highly economical.

In a year, however, all of the water from the drainage system of the Hnilec above the dam will pass through the power plant in the Velka Vlci Valley, into the exhaust canal, and through this to the Dobsina Creek, which empties into the Slana River.

The exhaust water passing from the power plant into Vlci Valley still undergoes a noteworthy drop after emptying into the Slana River. About one third of the drop is now being utilized in the so-called Step I; the program calls for the further utilization of the water power of the Hnilec River and Dobsina Creek when Step II of Dobsina is built.

The 295-meter maximum difference in elevation between the reservoir on the Hnilec River and the power plant in Vlci Valley, permits even a small quantity of water to exert enough pressure on the turbines and generators to produce a considerable amount of power, which is then distributed all over Slovakia. Few places in Slovakia offer such a drop in such a short distance, approximately 27 kilometers, between two water basins. This advantage will permit the gain of considerable valuable peak-load power at relatively small expense.

This power plant is the only one of its kind in Slovakia and is very important because it supplements the peak-load deficits of the thermal electric plants and the Vah River hydroelectric power plants. Since peak-load power is required only during certain periods of the day, it was necessary to construct a large storage reservoir on the Hnilec River. The present power plants cannot adjust to greater output during times of heavy demand because of the constant demand on them already; therefore, the maintenance of high output for a certain number of hours during the day would be very uneconomical for them. The Dobsina Power Plant is vitally necessary to supplement existing power plants because it provides an auxiliary supply of electric power when needed. It is ready at all times and it need not be kept in constant operation. It is one of the power plants which has improved the supply of electric current in the country.

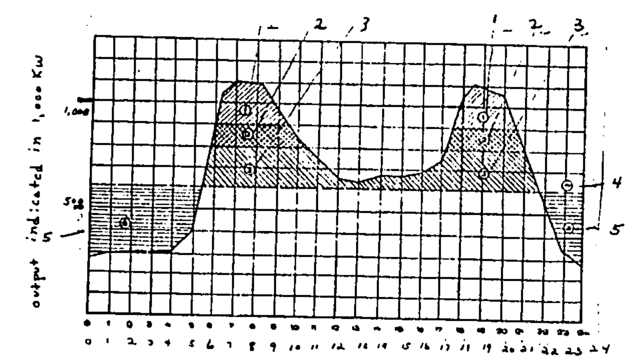

Figure 1. Example of the Consumption of Electric Power in Slovakia During the Course of One Day :

1. Peak, covered by production from Diesel-powered units.

2. Part of peak, covered by production of the Dobsina hydroelectric power plant.

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3. Part of consumption covered by the production of hydroelectric stations with facilities for storage.

4. Average production of thermal electric and hydroelectric power plants.

5. Surplus production of existing power plants, used for pumping.

Note: This example is not an actual situation. It is simply used as an illustration

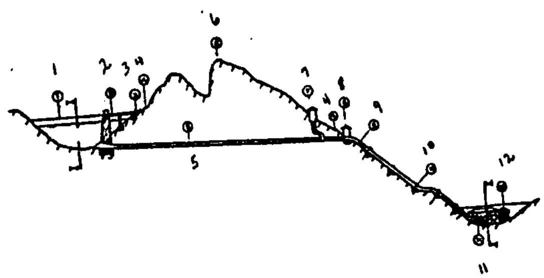

Figure 2. Plan of the Layout of the Various Installations on the Water Project in Dobsina.

1. Dam on the Hnilec River
2. Intake tower with bridge
3. Railroad track
4. Road
5. Intake water-pressure tunnel
6. Mountain
7. Equalizing chamber
8. Machine room
9. Steel pressure conduits
10. Concrete anchor blocks for steel conduits
11. Separating conduits to turbines
12. Vlci Valley dam

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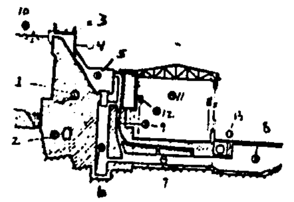

Figure 3. Cross Section of the Dam and Power Station in Velka Vlci Valley, Showing the Fall and Removal of Water:

1. Dam
2. Control tunnel inside dam walls
3. Crown of dam
4. Spillway
5. Catch basin for falling water
6. Shaft
7. Exhaust water canal
8. Tailwater from the hydroelectric plant
9. Ventilation shafts
10. Level of water in storage basin
11. Machine room of the power plant
12. Crane track (Zeriavova draha)
13. Water distribution conduits to turbines

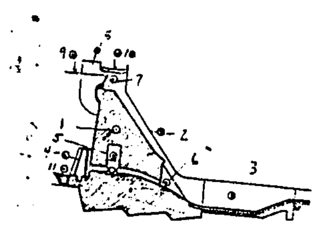

Figure 4. Plan of the Cross Section of the Block of the Dam on the Hnilec River.

1. Dam
2. Spillway

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3. Foot of spillway (Vyvarisko)
4. Trash rack (Ceslice) of the flow into the bottom outlet
5. Gates for the bottom outlet
6. Bottom outlet
7. Valve
8. Valve machine room
9. Level of water in basin
10. Crown of dam
11. Clay seal

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